

# IBM

## Technical Publication

## **UNDERSTANDING DESIGN AUTOMATION**

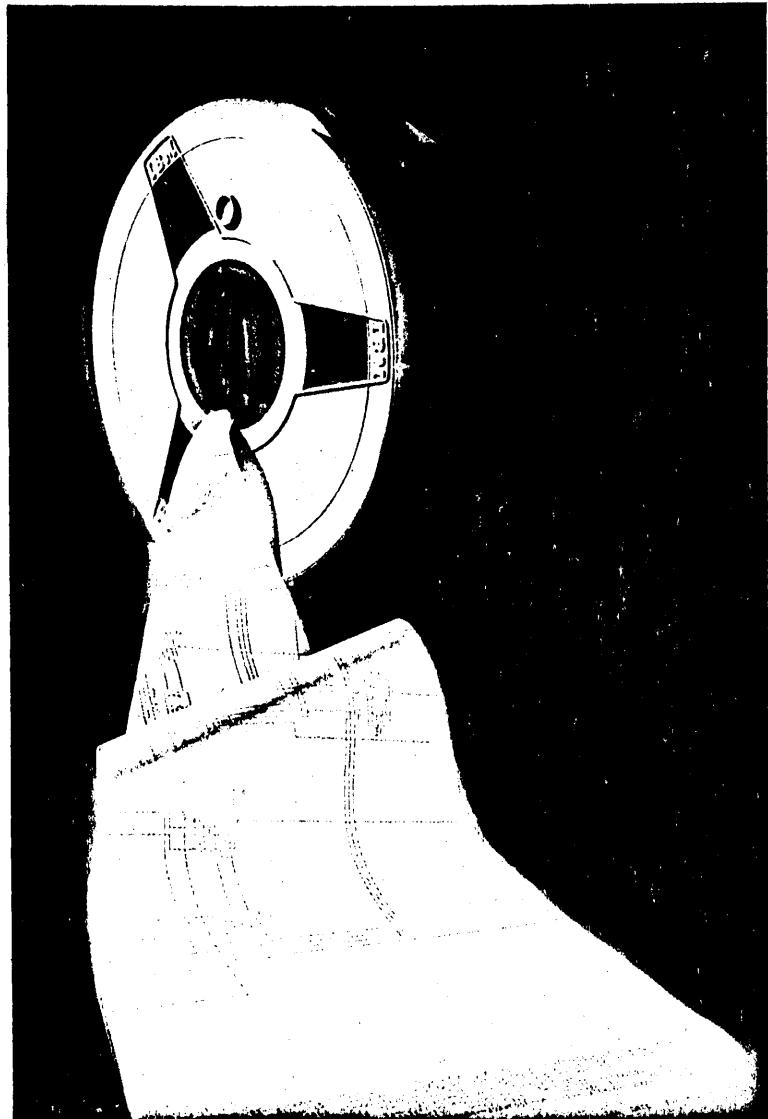
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**IBM**

**Product Development Laboratory, Data Systems Division  
International Business Machines Corporation, Poughkeepsie, New York**



## FOREWORD

The purpose of this brochure is to assist the engineer in understanding the over-all Design Automation System. The simple portrayal of the computer system with respect to inter-relations between the stages of the system and with respect to input-output documents is shown. Equally important facts such as (1) the procedure for implementing Design Automation, (2) the documents required for releasing a machine, and (3) the planning of workloads are stated. Becoming familiar with the following pages will lead to a better comprehension of how to effectively utilize Design Automation.

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## CLOSING THE DEVELOPMENT TIME GAP

Leadership in the computer field depends upon a company's ability to produce the most advanced data processing equipment. This in turn is dependent upon the utilization of advanced technologies as soon after their development as possible. The length of the time lag between the development of new circuitry and its incorporation in a new computer system, for example, can make the difference between success and failure.

Design automation is one means of closing the development time gap. It provides for the expeditious processing and updating of a machine by computer means. Computers are used for the preparation of manufacturing and customer engineering documents, the effective debugging on paper of a machine system, and the automatic routing of wire as well as the determining of wire-type on an SMS panel.

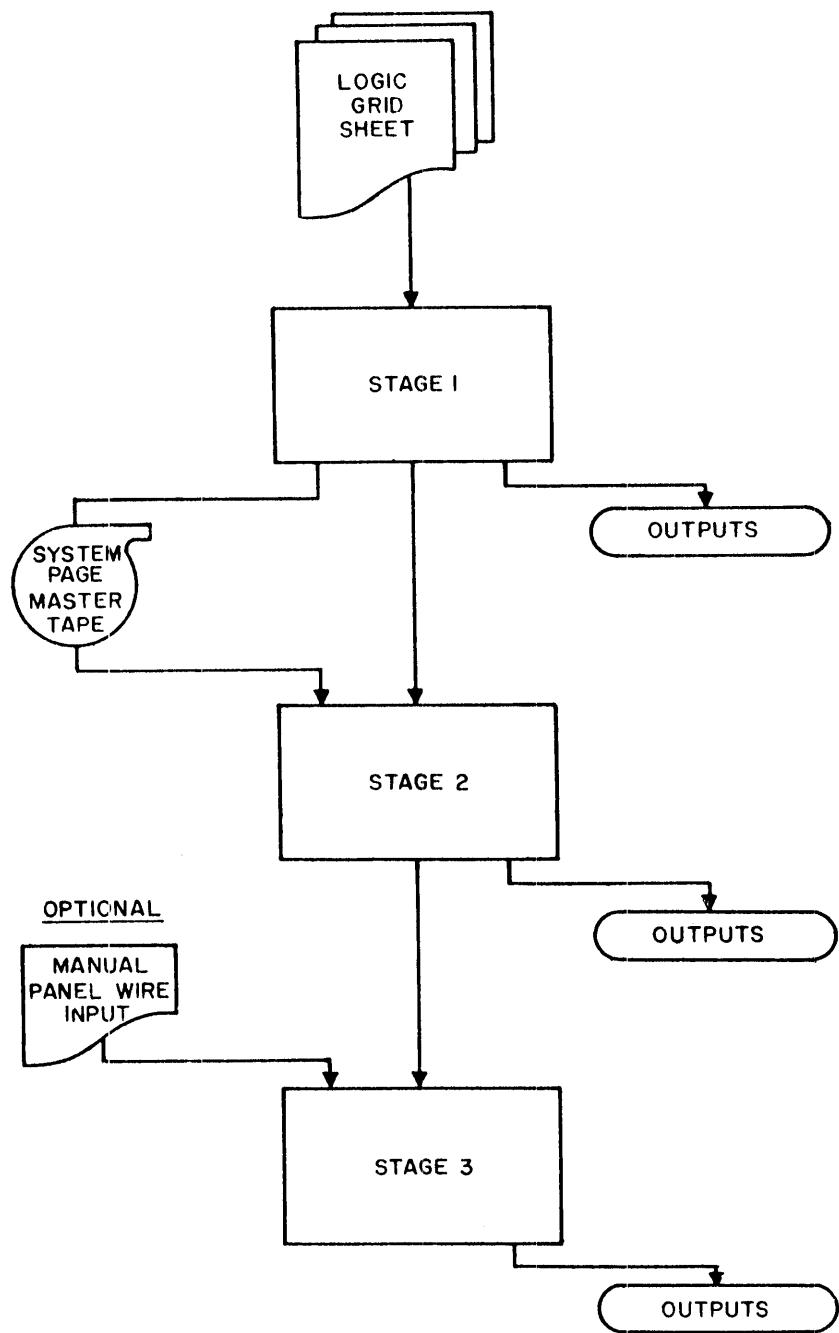
Another feature of design automation is the advantage of conformity of the logic representation. All machine systems are similar in respect to the layout of the system page. Customer engineering finds uniformity in system-page terminology helpful when educating men on two different machine systems.

Design automation is also a flexible and dynamic system. Program changes can be made to accommodate certain special requests. To obtain specific results, prespecifications that override certain computer decisions can be instituted. It is felt that the areas of machine simulation and fabrication offer the greatest promise for future progress in this program.

## THE DESIGN AUTOMATION PROGRAM

There are three basic stages within the design automation program: Stage 1, Preparation of system page master tape; Stage 2, System page validity check; Stage 3, Panel wiring. Each stage is dependent on the output of a preceding stage, yet every one is run separately. Numerous computer programs make up the framework of each stage. The scope of these particular programs will not be discussed here.

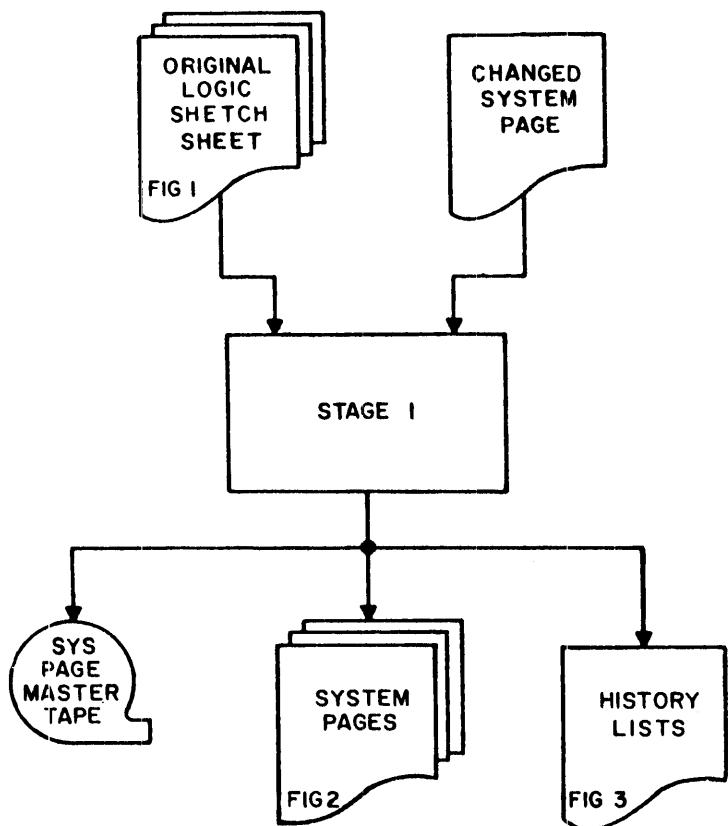
The outputs from the stages consist of documents which contribute to development of the final machine. The system page tape which is generated from Stage 1 is the master document from which subsequent stages operate, and to which all logical design changes or additions are applied. A manual panel wire input into Stage 3 is optional. Its purpose is to enable the processing of panel wiring in a uniform manner for special situations that require the first two stages to be by-passed. It is also used to enter service wiring, to enable engineering intervention, and to control unique situations while obtaining the bulk of the signal wiring automatically. A closer look at each of the three stages follows.



Three Stages of the General Program

Stage 1, Preparation of System Page Master Tape -- Original pages or changes to existing systems pages are keypunched into machine language, edited for accuracy, and merged in sequence by systems page number on the master tape. The master tape is the document from which system pages are printed and to which the checking programs are applied.

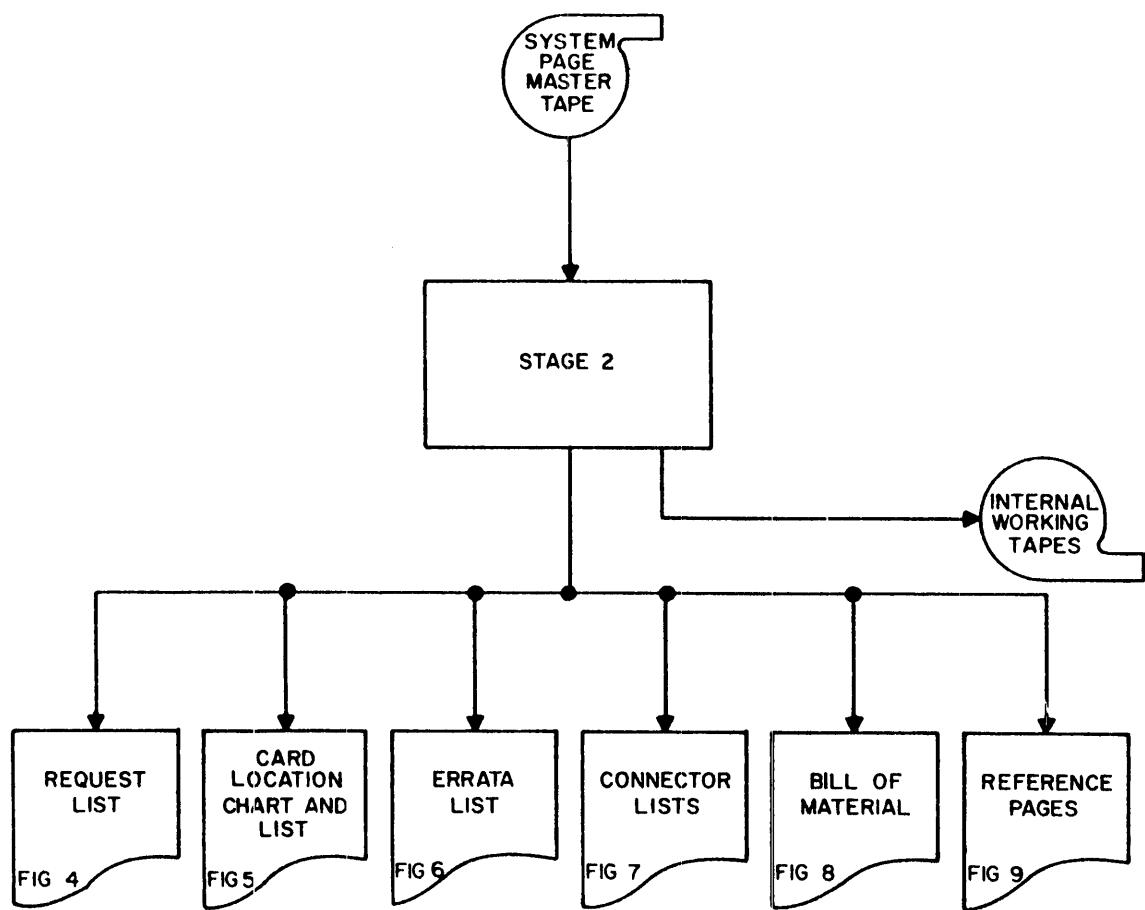
Blanket changes to systems pages on existing master tapes, such as changing machine designations, machine location on logic blocks, and system page numbering, can be accomplished by present computer programs. All released engineering levels for a released system page are retained on tape. System's printouts can be obtained for any page at any level.



Figures referred to here begin on page 10

Stage 1 - Preparation of System Page Master Tape

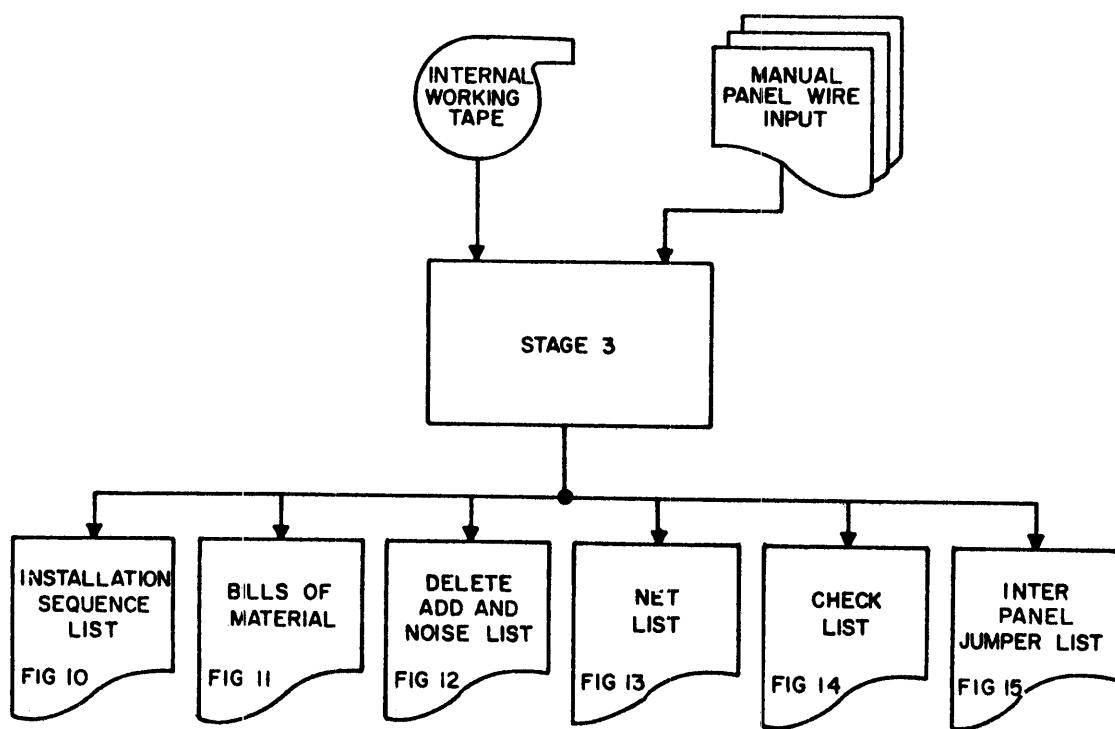
Stage 2, System Page Validity Check -- The machines systems are checked for electrical accuracy, interpage communication and package standardization. Errors are indicated, but not automatically corrected. The accumulation of data leads to direct outputs from Stage 2 as well as panel wiring outputs from Stage 3.



Figures referred to here begin on page 12

Stage 2 - System Page Validity Check

Stage 3, Panel Wiring -- Panel pin data accumulated from the systems pages or from manually produced data is automatically routed. Wire types are upgraded if the noise voltage pickup is detrimental to operation and downgraded if the length of the coaxial or twisted pair wire is impractical for installation. Add and delete instructions are produced when engineering changes are made to existing wired panels. Manual inputs to the program are only used when expedited panel wire changes are required.



Figures referred to here begin on page 17

#### Stage 3 - Panel Wiring

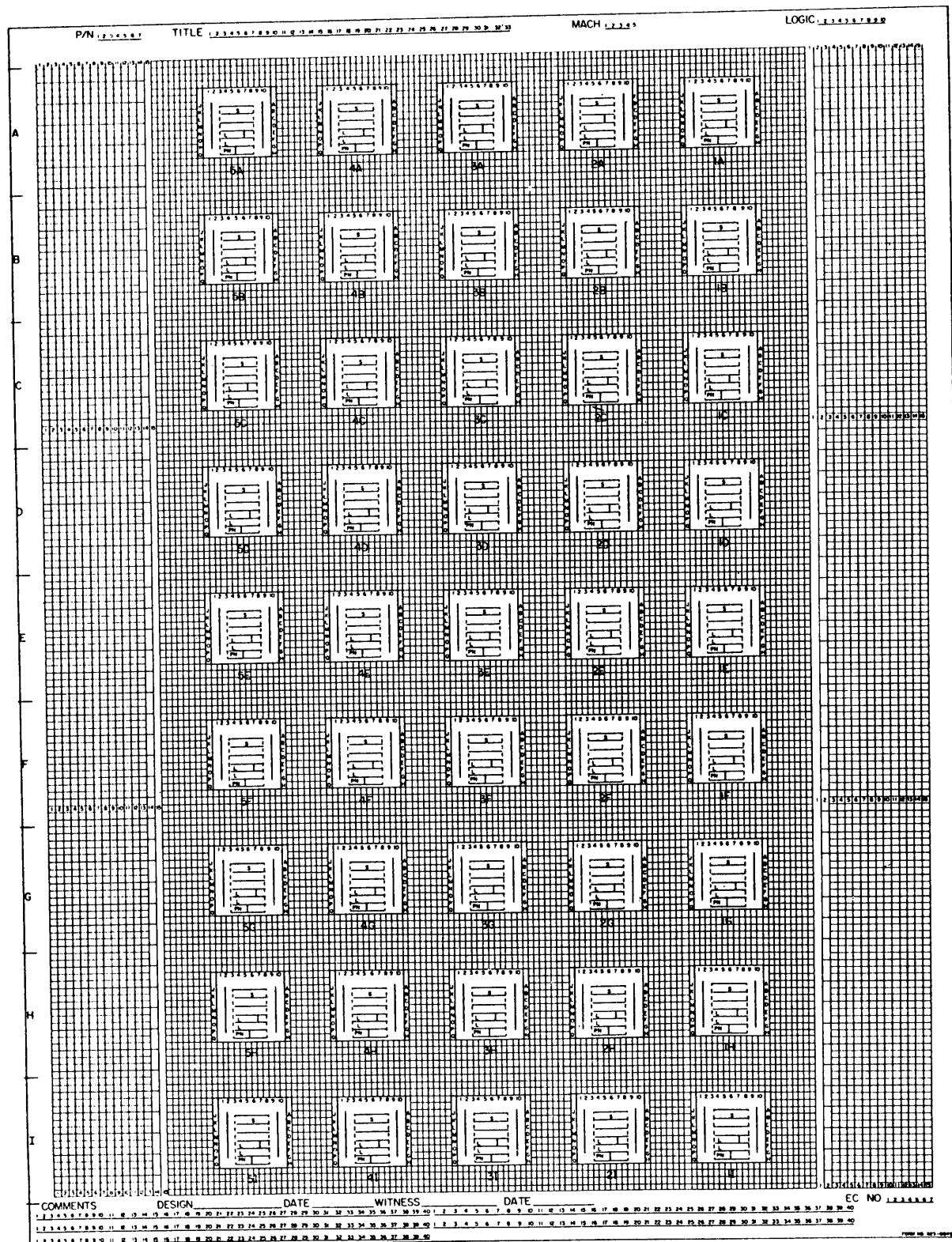
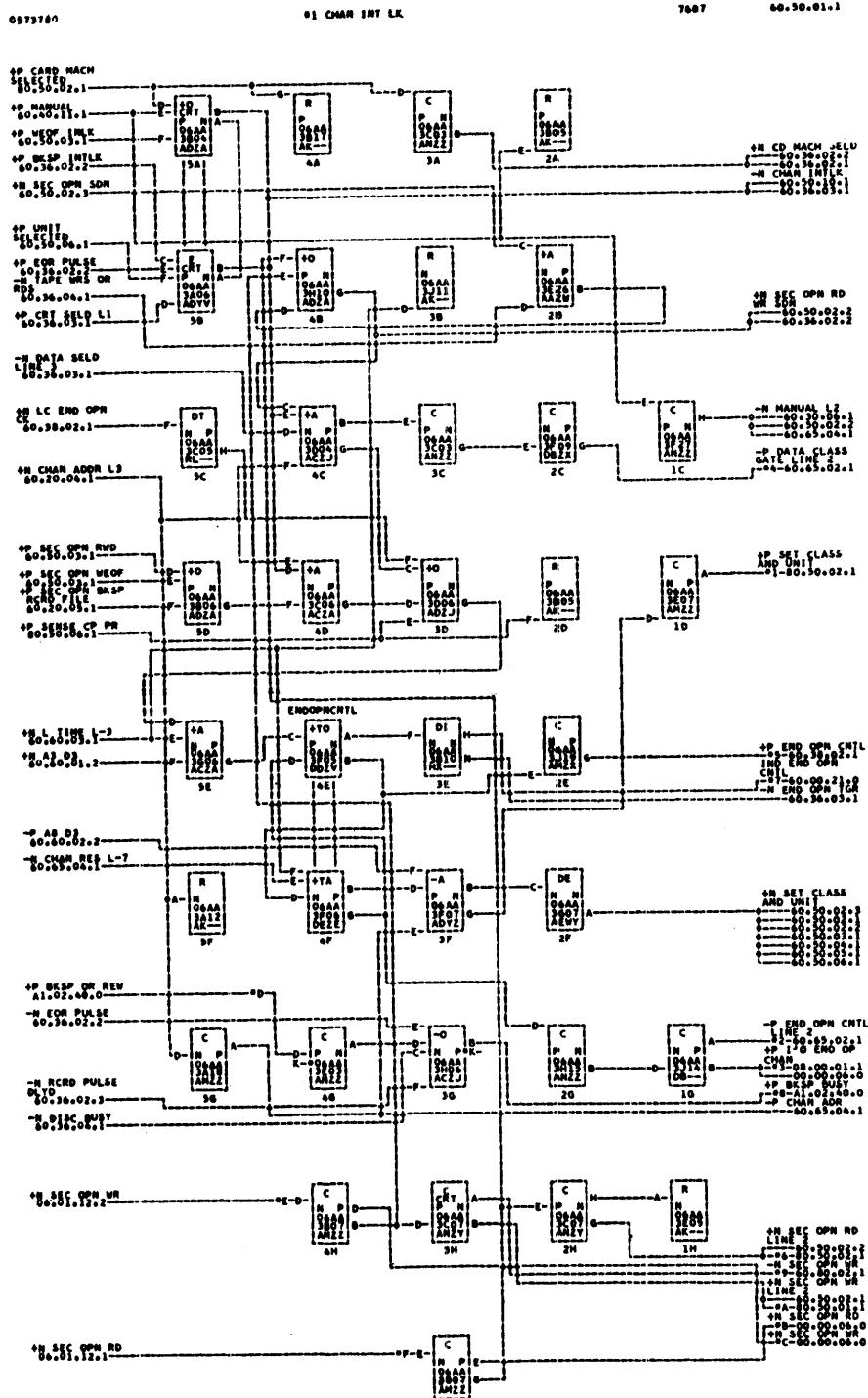


Figure 1 - Logic Sketch Sheet is the Page on which the Initial Logic of a Machine is Drawn



COMMÉTIS

TAG DATE E.C.NO. TAG DATE E.C.NO. TAG DATE E.C.NO. TAG DATE E.C.NO.

**Figure 2 - Systems Pages Contain a Printout of the Pages on the Master Tape**

RUN NO 113		MASTER TAPE HISTORY LISTING FOR MACH 7050			DATED	5-18-60
PAGE	P N	TITLE		TAG	ENG.CHG	DATE
10.01.10.1		OSCILLATOR		A	PREC029	11-25-59
				B	PREC040	12-18-59
				C	PREC050	12-29-59
				D	PREC075	2-09-60
				E	PREC087	2-24-60
				F	PREC113	5-14-60
10.01.11.1		CLOCK RING 1ST OF 2 SHEETS		A	PREC029	11-25-59
				B	PREC050	12-29-59
				C	PREC087	2-24-60
				D	PREC106	4-20-60
				E	PREC113	5-14-60
10.01.12.1		CLOCK RING 2ND OF 2 SHEETS		A	PREC029	11-25-59
				B	PREC040	12-18-59
				C	PREC050	12-29-59
				D	PREC075	2-09-60
				E	PREC087	2-24-60
				F	PREC113	5-14-60
10.01.13.1		USE OR MANUAL STATUS CONTROL		A	PREC029	11-25-59
				B	PREC040	12-18-59
				C	PREC050	12-29-59
				D	PREC075	2-09-60
				E	PREC084	2-20-60
				F	PREC087	2-24-60
				G	PREC090	3-03-60
				H	PREC098	3-21-60
				I	PREC106	4-20-60
				J	PREC113	5-14-60
10.01.14.1		START MEM TRIGGER		A	PREC029	11-25-59
				B	PREC040	12-18-59
				C	PREC050	12-29-59
				D	PREC075	2-09-60
				E	PREC084	2-20-60
				F	PREC087	2-24-60
				G	PREC090	3-03-60
				H	PREC113	5-14-60
10.02.10.1		PULSE DISTRIBUTION GATING LINES		A	PREC029	11-25-59
				B	PREC040	12-18-59
				C	PREC050	12-29-59
				D	PREC075	2-09-60

Figure 3 - History List is an Index of all Pages Contained on the Master Tape

REQUEST LIST						REMARKS
MACHINE	LOGIC NO.	PART NO.	TAG	E.C.NO.	PAGE NAME	
7701	0107011	0555170	D	PREC004	READ CONTROL	
7701	0107012	0555171	D	PREC004	READ BUS	
7701	0107021	0555172	C	PREC004	WRITE CONTROL	
7701	0107022	0550173	C	PREC004	WRITE BUS	
7701	0107031	0550174	C	PREC004	ERROR CONTROL	
7701	0107032	0555175	C	PREC004	RECORD SUBSTITUTION	
7701	0107033	0555176	D	PREC004	1ST CHAR BACKSPACE	
7701	0107041	0550177	C	PREC004	READY AND REWIND CONTROL	
7701	0107042	0555178	D	PREC004	TAPE INDICATION	
7701	0107043	0550179	C	PREC004	DOOR CONTROL	
7701	0107051	0555180	D	PREC004	SWITCHES	
7701	0107052	0550181	B	PREC002	SWITCHES	

Figure 4 - Request List Contains the Systems Page Numbers that are Included in the Checking Run

557049	E-C. 247911	CIRCUIT CARD LOCATION CHART						
MACHINE NO 7102	PREV. E-C. 247664	PUR: 041						
A	b	C	D	E	F	G	H	J K L M N O P Q R S T U V W X Y Z
01								
02								
03	DEZA IE	DEXC IE	DBZX IE	DEXC IE	DEXC IE	DEXC IE	DEXC IE	
04	DEZA IE	DEXC IE	DDZX IE	DEXC IE	DEXC IE	DEXC IE	DEXC IE	
05	DEZA IE	DEXC IE	DDZX IE	DEXC IE	DEXC IE	DEXC IE	DEXC IE	
06	DEZA IE		DFZA IE					
07	EF-- 11101111 1H	DEXE 11101101 1H	DEZA 11101101 1H					
08	EF-- 11101111 1H	DEXD 11101111 1H	DEZA 11101101 1H					
09	EF-- 11101111 1D	DEXD 11101111 1D	DEZA 11101101 1D					
10	EF-- 11101111 1A	DEXD 11101111 1A	DEZA 11101101 1A					
11	DCDX 10	DEXC 10	DEFA 10	DEXC 10	DEXC 10	DEXC 10	DEXC 10	
12	DE-- 20.05110. 5E	DEXC 11101111 1H	DEZA 11101101 1H					
13	DE-- 20.05111. 5E	DEXC 11101111 1H	DEZA 11101101 1H					
14	DE-- 20.05111. 5E	DEXC 11101111 1H	DEZA 11101101 1H					

**Figure 5 - Card Location Chart and List Indicates Location of Circuit Card within a Panel. Available Circuits as well as Page Designations as to where a Circuit is Logically Represented are Indicated**

## AUTOMATION OF DESIGN - POUGHKEEPSIE DEVIATION FROM DESIGN STANDARDS

MACHINE # 7701

RUN 703

01.07.01.1

THE FOLLOWING CONNECTOR IS USED MORE THAN ONCE

WITH BLOCK		28 AND BLOCK 1A ON PAGE	01-07-02-1	
01B6C01R	28	5G	01-07-03-1	
	2C	2B	01-07-03-2	
	2C	4A	01-07-03-2	
	2C	5F	01-07-03-3	
	3C	2C	01-07-02-1	
	3C	3F	01-07-02-1	
	3C	5I	01-07-02-2	
	3C	3D	01-07-03-1	
	3C	4I	01-07-03-1	
	3C	3H	01-07-03-2	
01B6C01A	3C	5E	01-07-03-2	
	3C	4B	01-07-03-3	
	3C	4E	01-07-03-3	
	3C	3B	01-07-04-1	
	3C	3C	01-07-04-1	
	3C	3B	01-07-04-2	
	4A	4C	01-07-02-1	
	4A	5C	01-07-02-1	
	4A	5I	01-07-03-1	
	01B6D01Q	4A	5F	01-07-03-3
WITH BLOCK		5F ON PAGE	01-07-03-1	
01B6C01N		5E	3A	01-07-03-1
01B6D01D	5F	5H	01-07-02-1	

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**Figure 6 - Errata List Consists of the Errors Contained on Systems Pages.**  
**Errors are Indicated by Page and Classified as Electrical**  
**Deficiency, etc.**

PANEL LOCATION	CONNECTOR LOCATION	LIST	MACH	7	10/11	MFI	PREV	EC	246915
LOCATION	13A1	PART NUMBER	L.C.	7	94	RUN	694	PAGE	003
CONNECTOR	PAGE	BLCK	NET	LINE	NAME				
13A1B2AB	27.09.03.1	4E	009553	6P	SUM 12	TO MEM AREA DEC			
13A1B2BC	27.09.03.1	4E	009552	6P	SUM 13	TO MEM AREA DEC			
13A1B2BD	27.09.02.1	4C	009527	6P	SUM 18	TO MEM AREA DEC			
13A1B2BF	27.09.02.1	4A	009525	6P	SUM 19	TO MEM AREA DEC			
13A1B2BG	27.09.01.1	4G	009506	6P	SUM 20	TO MEM AREA DEC			
13A1B2BH	27.09.01.1	4E	009505	6P	SUM 21	TO MEM AREA DEC			
13A1B2BK	27.09.01.1	4C	009504	6P	SUM 22	TO MEM AREA DEC			
13A1B2BL	27.09.01.1	4A	009503	6P	SUM 23	TO MEM AREA DEC			
13A1C2BH	27.09.06.1	4G	009621	6P	SUM 00	TO MEM AREA DEC			
13A1C2BC	27.09.06.1	4E	009620	6P	SUM 01	TO MEM AREA DEC			
13A1C2BD	27.09.06.1	4C	009619	6P	SUM 02	TO MEM AREA DEC			
13A1C2BF	27.09.06.1	4A	009618	6P	SUM 03	TO MEM AREA DEC			
13A1C2BG	27.09.05.1	4G	009597	6P	SUM 04	TO MEM AREA DEC			
13A1C2BH	27.09.05.1	4E	009596	6P	SUM 05	TO MEM AREA DEC			
13A1C2BK	27.09.05.1	4C	009595	6P	SUM 06	TO MEM AREA DEC			
13A1C2BL	27.09.05.1	4A	009594	6P	SUM 07	TO MEM AREA DEC			
13A1C2BM	27.09.04.1	4G	009575	6P	SUM 08	TO MEM AREA DEC			
13A1C2BR	27.09.04.1	4F	009574	6P	SUM 09	TO MEM AREA DEC			
13A1C2BR	27.09.04.1	4C	009573	6P	SUM 10	TO MEM AREA DEC			
13A1C2BR	27.09.04.1	4A	009572	6P	SUM 11	TO MEM AREA DEC			
13A1D2BR	27.11.04.1	2A	009848						
13A1D2RC	27.11.04.1	2C	009849						
13A1D2RD	27.11.04.1	2F	009850						
13A1D2RF	27.11.04.1	2G	009851						
13A1D2RG	27.11.05.1	2A	009891						
13A1D2RH	27.11.05.1	2C	009892						
13A1D2RK	27.11.05.1	2F	009893						
13A1D2RL	27.11.05.1	2G	009894						
13A1D2RM	27.11.06.1	2A	009934						
13A1D2RP	27.11.06.1	2C	009935						
13A1D2RQ	27.11.06.1	2F	009936						
13A1D2RQ	27.11.06.1	2G	009937						
13A1F2RA	27.14.02.1	5H	007185	-P	FLO LENGTH 1 WORD				
13A1F2RC	27.13.05.1	5F	006211	6N	Z18 ADDER				
13A1F2RD	27.13.05.1	5G	006370	6N	PZ18 23 PA				
13A1F2RF	27.13.05.1	5D	006794	6N	Z50 ADDER DC				
13A1F2RG	27.13.05.1	5F	006869	6N	Z P50 57 PA				
13A1F2RH	27.09.04.1	4A	009816	6N	SUM 11 TO RECOMP				
13A1F2HK	27.10.04.1	3C	009692	6N	PARITY HALF SUMS 00 07				
13A1F2BL	27.10.02.1	3C	009691	-N	PARITY HALF SUMS 00 07				
13A1F2BM	27.10.01.1	4C	009682						
13A1F2BQ	27.09.04.1	4C	009526	-P	SUM 18 RECOMP				
13A1F2BR	27.11.06.1	2G	00874	6P	HALF SUM 23 TO ADDER CHKR				

**Figure 7 - Connector Lists Consists of Used and Unused Connectors on SMS Panels, Cable Wiring and Tailgate Wiring.**

BILL OF MATERIAL											
IBM		NAME: K 00	KUN: 664	TYPE: I	ZINE:	PART NUMBER: 1	PROD. NO. OR ACCOUNT NO: ENGINEERING DRAFT	SP. NO. NUMBER: 100020	SHEET NO:		
END CHG'D BY DATE	BASIC NAME	DESCRIPTION	M	CM	ZONE CLASS	PART NO. OR RAW MATER. CODE	UNIT MEAS	QUANTITY	REFERENCE	ORDER NO.	DEPT. LOKING
247240	CARD A	10U--		A		0371143		0			
247240	CARD A	10R--		A		0371146		1			
247240	CARD A	10X--		A		0371049		36			
247240	CARD A	10--		A		0371196		1			
247240	CARD A	ANZZ		A		0371200		25			
247240	CARD A	ANZY		A		0371201		6			
247240	CARD A	ANZX		A		0371202		5			
247240	CARD A	ANZM		A		0371204		55			
247240	CARD A	ANZV		A		0371205		1			
247240	CARD A	ANZU		A		0371206		1			
247240	CARD A	ANZZ		A		0371207		15			
247240	CARD A	ANZY		A		0371210		5			
247240	CARD A	ANZX		A		0371211		24			
247240	CARD A	AN--		A		0371212		1			
247240	CARD A	10LY		A		0371213		25			
247240	CARD A	10ZV		A		0371214		17			
DATE									RELEASE <input checked="" type="checkbox"/>	DATE	
END CHG'D BY									REVISE <input checked="" type="checkbox"/>	TYPED	
PREP'D BY					CHN'D BY						PREP'D BY
PL. PLANNING CODES	PL.	CH. CHARACTER CODE	CH.								
01 PIECE EACH 02 C OR 100 PCS 12 FEET UNIT OF MEASURE CODE 31 TON (NET) 61 PER M 81-DRUM 03 SET 04 REAM 13 GROSS 32 OUNCE (TROY) 62 PER LINEAR FT 82-CASE 05 SET 06 SHEET 15 60 FEET 11 CU FEET 33 OUNCE 63 PINT 83-CARTON 08 ROLL,SPool,BALL 09 BALE 16 60 INCH 11 PER 100 FT 34 POUND 64 QUART 84-TUBE 09 SHEET 11 INCH 17 60 FEET 11 PER 100 FT 35 GALLON 65 CANISTER 85-CANISTER 10 SHEET 12 INCH											

PREP'D BY:   
 1. BIG. USRNSC 2. L. DNP ITEM 3. C.C. CARD  
 4. B. B. M. 5. R. M. 6. R. M. 7. R. M.  
 8. COMB. OF 10. 9. R. M. 11. R. M.

**Figure 8 - Bill of Materials List the Circuit Cards that are Used within the Machine.**

P.D. 546221  
FROM 7090

REFERENCE PAGE		A1.02.30.0	
INPUTS TO CONTROL UNIT		TO TAU 1	
PAGE	NAME	PAGE	
60.40.17.1	P MANUAL WRITE DISC	GP MANUAL WRITEDISC	A1.30.11.1
60.36.04.1	-N WC & DISC	-N MANUAL OP	A1.30.11.1
60.25.20.1	GN 1 DATA LINE	GN 1 DATA LINE	A1.40.40.1
60.34.03.1	GN 2 DATA LINE	GN 2 DATA LINE	A1.40.40.1
60.25.18.1	GN 4 DATA LINE	GN 4 DATA LINE	A1.40.40.1
60.34.03.1	GN R DATA LINE	GN 8 DATA LINE	A1.40.40.1
60.34.02.1	GN A DATA LINE	GN A DATA LINE	A1.40.40.1
60.34.02.1	GN B DATA LINE	GN B DATA LINE	A1.40.40.1
60.34.02.1	GN C DATA LINE	GN C DATA LINE	A1.40.40.1
60.34.03.1	GP 1 MANUAL	GP 1 MANUAL	A1.40.50.1
60.34.03.1	GP 2 MANUAL	GP 2 MANUAL	A1.40.50.1
60.14.03.1	GP 4 MANUAL	GP 4 MANUAL	A1.40.50.1
60.34.03.1	GP B MANUAL	GP B MANUAL	A1.40.50.1
60.34.03.1	GP COMPARE CHK	GP COMPARE CHK	A1.50.10.1
60.34.03.1	GP A MANUAL	GP A MANUAL	A1.40.50.1
60.24.03.1	GP REQ R ONLY	GP REQ B ONLY	A1.50.10.1
60.34.03.1	GP B MANUAL	GP B MANUAL	A1.40.50.1
60.34.03.1	GP REQ A ONLY	GP REQ A ONLY	A1.50.10.1
60.34.03.1	GP C MANUAL	GP C MANUAL	A1.40.50.1
60.34.03.1	GP AMP BIAS	GP AMP BIAS	A1.40.10.1
60.36.05.1	GP ERROR TGR RESET	GP MANUAL ERRORRESET	A1.50.50.1
60.36.05.1	-N WR ECHO	-N WR ECHO	A1.50.50.1
60.36.05.1	GP SEL & RDY MIV	GP SEL & RDY MIV	A1.60.01.1
60.36.05.1	GP SEL & RDY M II	GP SEL & RDY M II	A1.60.01.1
60.40.17.1	-P MANUAL STOP ON ERROR	-P MANUAL STOP ON ERROR	A1.60.10.1
60.50.02.2	GP ODD RED CALL	GP ODD RED CALL	A1.40.60.1
60.50.02.2	GP EVEN RED CALL	GP EVEN RED CALL	A1.40.60.1
60.50.02.2	GP READ CALL	GP READ CALL	A1.60.20.1
60.50.02.1	GP WRITE CALL	GP WRITE CALL	A1.60.30.1
60.50.07.1	GP W TM CALL	GP W TM CALL	A1.60.31.1
60.50.07.1	GP WEOF CALL	GP ERASE CALL	A1.60.31.1
60.50.03.1	GP BKSP CALL	GP BKSP CALL	A1.60.40.1
60.36.03.1	GP DISC CALL	GP DISC CALL	A1.60.50.1
60.36.03.1	GP MANUAL WRITEDISC	GP MANUAL WRITEDISC	A1.60.50.1
60.50.07.1	GP REWIND CALL	GP REWIND CALL	A1.60.50.1
60.50.02.2	GP REW UNLOAD CALL	GP REW UNLOAD CALL	A1.60.50.1
60.40.17.1	GN TURN OFF TI	GN TURN OFF TI	A1.60.60.1
60.40.17.1	-P TURN ON TI	-P TURN ON TI	A1.60.60.1
60.50.02.2	GN SET HI DENSITY	GN SET HI DENSITY	A1.60.60.1
60.50.02.2	-P SET LO DENSITY	-P SET LO DENSITY	A1.60.60.1
60.34.04.1	GP CTL DISC	GP MACHINE OR PWR ON RESET	A1.70.01.1
60.34.06.1	GP SEL RDY & WR	GP SEL RDY & WR	A1.60.10.1
60.34.06.1	GP SEL RDY & RD	GP SEL RDY & RD	A1.60.10.1
60.34.03.1	GN EARLY SAMPLE	GN EARLY SAMPLE	A1.10.30.1 A1.50.10.1
60.34.11.1	THERMAL INTERLOCK	THERMAL INTERLOCK	A1.70.01.1

Figure 9 - Reference Pages Consist of Items such as Intermachine Communication Lists or System Pages from which Indicator Lights are Actuated.

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## SMS CHASSIS WIRE LIST

TYPE OF LIST INSTALL. SEQ. SECT.C				TYPE OF CHASSIS	MACHINE TYPE	FRAME	DATE OF MODULE	CHASSIS	RELEASED FOR ASW PRESENT	SYN	E.C. NO.	-	DATE	VERSION OR RFI	SHEET NO.	LIST NO.	
07-20-60				SLG	7102	01	A	I	PREVIOUS		248041	-	-	SUB0001	37	0557151	
SIGNAL																	
TWISTED PAIR OR COAX																	
ITEM	WIRE TYPE	NET NUMBER	WIRE NO. IN NET	TOTAL WIRE LENGTH	FROM PIR LOCATION	TERMINATOR VIA PIR LOCATION	BODY	VIA PIR LOCATION	TERMINATOR VIA PIR LOCATION	TO LEVEL	FROM PIR LOCATION	TO PIR LOCATION	REFERENCE SIGNAL LENGTH LEVEL	REF PIR LOCATION	REFERENCE SIGNAL LENGTH LEVEL	REF PIR LOCATION	
H	T	003379	12	1	2	C100			F100	1	F10F	2	3	C10J	2	0	F10J
H	T	011023	12	5	2	F16F				1	J1GM	2	0	F17J	2	0	J16J
H	T	003383	12	7	2	D100				1	G10M	2	3	D10J	2	0	G11J
H	T	003399	15	5	2	C10A			C10D	1	G11F	2	0	C10*	2	0	G11J
H	T	003157	16	0	2	C23A			D09F	1	F09R	2	0	C23*	2	5	F09J
H	T	001530	17	3	2	B03E				1	G03E	3	3	C03*	3	1	G05*
H	T	001528	18	4	2	G03R			K28E	1	K28H	2	0	H03J	2	0	K28E
H	T	010985	20	7	2	B15B			B16H	1	H18C	3	7	C15J	2	3	H18J
H	T	010986	20	7	2	B15H			D16C	1	H18H	3	0	C15J	1	7	H18J
H	T	005730	22	5	2	D04L			G04K	1	J200	3	3	D03J	2	0	K20*
H	T	001524	23	1	2	E05E			H04H	1	J03E	3	3	C05*	2	5	J03*
H	T	011036	23	5	2	B14B			D15J	1	J18R	3	7	C14J	2	0	J18*
H	T	011037	23	5	2	B14H			C15Q	1	J18F	3	0	C14J	2	5	J18*
H	T	010984	24	1	2	B16H			E17E	1	H19G	4	1		2	1	
				24	5												

Figure 10 - Installation Sequence List Indicates Sequence in which a Panel should be Wired.

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## SMS CHASSIS WIRE LIST

TYPE OF LIST INSTALL. SEQ. SECT.C				TYPE OF CHASSIS	MACHINE TYPE	FRAME	DATE OF MODULE	CHASSIS	RELEASED FOR ASW PRESENT	SYN	E.C. NO.	-	DATE	VERSION OR RFI	SHEET NO.	LIST NO.
07-20-60				SLG	7102	01	A	I	PREVIOUS		248041	-	-	SUB0001	40	0557151
SIGNAL																
TWISTED PAIR OR COAX																
ITEM	WIRE TYPE	NET NUMBER	WIRE NO. IN NET	TOTAL WIRE LENGTH	FROM PIR LOCATION	TERMINATOR VIA PIR LOCATION	BODY	VIA PIR LOCATION	TERMINATOR VIA PIR LOCATION	TO LEVEL	FROM PIR LOCATION	TO PIR LOCATION	REFERENCE SIGNAL LENGTH LEVEL	REF PIR LOCATION	REFERENCE SIGNAL LENGTH LEVEL	REF PIR LOCATION
					T	V	S	N	NUMBER OF WIRES	LENGTH	IN INCHES					
									070		03.7					
									026		03.9					
									045		04.0					
									022		04.1					
									009		04.3					
									011		04.4					
									018		04.5					
									010		04.6					
									005		04.7					
									012		04.9					
									006		05.0					
									005		05.1					
									008		05.3					
									002		05.4					
									005		05.5					
									006		05.6					
									007		05.7					
									009		05.9					
									019		06.0					
									004		06.1					
									004		06.3					
									007		06.4					
									007		06.5					
									012		06.6					
									000							

Figure 11 - Bill of Material List all Wires on Panel by Length, Quantity and Type.

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## SMS CHASSIS WIRE LIST

TYPE OF LIST			TYPE OF CHASSIS	MACHINE TYPE	FRAME	DATE OF MODULE	CHASSIS	RELEASED FOR ASW PRESENT	SYM	E.C. NO.	DATE	VERSION OR MFI	HEET NO.	LIST NO.		
AUTOMATED NOISE SECT. F				7102	01	A	2	PREVIOUS		248041	--		3	0557152		
07-19-60										247911				0557152		
SIGNAL																
WIRE TYPE	NET NUMBER	WIRE NO. IN NET	TOTAL WIRE LENGTH	FROM PIN LOCATION	BODY			TO PIN LOCATION	FROM			TWISTED PAIR OR COAX			ENG. DATA	
					VIA PIN LOCATION	VIA PIN LOCATION	VIA PIN LOCATION	LEVEL	VIA PIN LOCATION	SIGNAL LENGTH	REFERENCE LENGTH LEVEL	REF PIN LOCATION	SIGNAL LENGTH	REFERENCE LENGTH LEVEL	REF PIN LOCATION	
V	000771	5.6	1	F10G	F10B			1	F13G							50.7
T	000771	7.9	1	H01P	H02L		J09/	1	J09C							8.3 T
T	000771	11.4	2	J09C				2	F10G							46.9 T
T	000771	12.1	2	F13G				2	C13D							59.8 T
V	000772	5.4	1	F10E				1	F13E							17.5
V	000772	6.1	1	K09R				1	J09B							43.7
C	000772	8.6	1	H01R			J09G	1	J09B							C
T	000772	9.1	2	F13E				2	D13D							45.7 T
V	000772	14.1	2	K09R			K09D	2	F10E							135.6 V
V	000789	5.4	1	DD9G				1	D12E							22.5
V	000789	5.9	1	D03E			D05/	1	D06G							33.7
V	000789	5.6	2	D06G				2	D09G							35.0
T	000789	7.9	1	E01R			E02D	1	D03E							13.9 T
V	000789	13.1	2	D12E			F12K	2	G16G							154.4 V
V	000792	5.4	2	C09B				2	C12C							13.1
V	000792	5.6	1	C06B			C09E	1	C09B							13.1
T	000792	7.5	1	E01M			D02N	1	D03F							32.2 T
T	000792	7.5	2	D03F			D06c	2	C06B							14.4 T
V	000792	7.9	1	C12C			C12F	1	D16G							77.5
V	000815	4.3	1	G22R				1	G22K							28.1
T	000815	7.5	2	G22R			G28E	2	G28M							5.4 T
V	000815	11.9	2	G22K			G23G	2	D23K							268.7 V
V	000822	7.1	1	F22H				1	F27A							8.7
V	000822	7.1	1	D16F			F26/	1	F22H							101.9
V	000822	7.1	1	'26M			'27A	1	F27A							101.9

Figure 12 - Delete-Add and Noise Lists Contain Changes that must be Applied to Existing Panel Plus Wires that have Excessive Noise Pickup.

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## SMS CHASSIS WIRE LIST

TYPE OF LIST			TYPE OF CHASSIS	MACHINE TYPE	FRAME	DATE OF MODULE	CHASSIS	RELEASED FOR ASW PRESENT	SYM	E.C. NO.	DATE	VERSION OR MFI	HEET NO.	LIST NO.		
AUTOMATED NET SECT. A				SLG	7102	01	A	2	PREVIOUS		248041	--		30	0557152	
07-19-60										247911					0557152	
SIGNAL																
WIRE TYPE	NET NUMBER	WIRE NO. IN NET	TOTAL WIRE LENGTH	FROM PIN LOCATION	BODY			TO PIN LOCATION	FROM			TWISTED PAIR OR COAX			ENG. DATA	
					VIA PIN LOCATION	VIA PIN LOCATION	VIA PIN LOCATION	LEVEL	VIA PIN LOCATION	SIGNAL LENGTH	REFERENCE LENGTH LEVEL	REF PIN LOCATION	SIGNAL LENGTH	REFERENCE LENGTH LEVEL	REF PIN LOCATION	
R	V	001540	6.4	2	G14D		H14D		1	H13D						
H	T	001541	14.9	1	D14D		H14C		1	H13F		2 3	014J			
A	V	001543	4.3	1	H13E				1	H14H						
R	V	001544	3.7	2	J15E				2	J15G						
R	V	001544	3.9	1	J15B				1	J15E						
R	V	001544	5.3	1	H14E		H14K		1	H14H						
R	V	001544	5.6	2	H16H		J16=		2	J15B						
R	V	001544	6.3	1	J15G				1	K15G						
R	V	001546	4.6	1	J15A			J16C	1	J16F						
R	V	001548	6.0	1	J15F			J16G	1	K16B						
R	V	001550	7.5	1	J15D			J16E	1	K16M						
R	V	001551	3.7	1	B19A				1	B19B						
H	T	001551	6.6	1	K15F			K18D	1	T19B						
H	T	001551	27.9	2	B19A			K16J	2	K15F		2 0	K15J	1 7	T19A	0 T T
H	T	001559	6.6	1	A15K			B19-	1	B19D		1 7	P15J	2 3	B19J	1 F T
R	V	001561	10.6	1	F22B		H23-	H26C	1	H26F						
R	V	001561	15.4	2	F22B			H27A	1	G02M						
R	V	001563	6.9	1	G23K		G24Q		1	H27F						
R	V	001563	18.1	2	G23K		F23E		1	M-						

Figure 13 - Net List Contains Panel Wires in Order of Reference Net Number.

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## SMS CHASSIS WIRE LIST

TYPE OF LIST AUTOMATED CHECK SECT.B 07-20-60				TYPE OF CHASSIS SLG	MACHINE TYPE 7102	FRAME 02	GATE OR MODULE A	CHASSIS 2	RELEASED FOR AND PRESENT PREVIOUS	SYN	IC NO 248041	-	-	DATE 247911	VERSION OR DFI	INSET NO 83	LIST NO 0557169 0557169																
SIGNAL																TWISTED PAIR OR COAX								ENG. DATA									
R	S	WIRE TYPE	NET NUMBER	WIRE NET IN NET	TOTAL WIRE LENGTH	FROM PIN LOCATION	TERMINATOR VIA PIN LOCATION	PORT	VIA PIN LOCATION	TERMINATOR VIA PIN LOCATION	TO LEVEL	FROM PIN LOCATION	SIGNAL LENGTH	REFERENCE LEVEL	DEF PIN LOCATION	PORT	TERMINATOR VIA PIN LOCATION	TO LEVEL	FROM PIN LOCATION	SIGNAL LENGTH	REFERENCE LEVEL	DEF PIN LOCATION	SP TYPE	SP NUMBER	SP TYPE	SP NUMBER	SP TYPE	SP NUMBER					
H	T	006628		11.9	1	J28G					1	F28F	7.4		626J		4.4		E27J														
R	V	007386		6.7	1	J29H					1	J23H																					
R	V	007386		6.9	2	J29H					2	H26F																					
R	V	007314		4.5	1	J28K					1	J26P																					
R	V	006447		3.7	1	J28L					1	J28H																					
R	V	007308		4.0	1	J28M					2	J28R																					
R	V	006447		3.7	1	J28N					1	J28L																					
R	V	006447		4.0	2	J29N					1	J27L																					
R	V	007396		5.6	1	J28P					1	J26C																					
H	T	007396		8.4	2	J28P					2	H24G	2.3		J28J		1.7		H24J														
H	T	005597		29.3	1	J29Q					2	C02C	5.6		H26J		7.6		A04C														
R	V	007308		4.1	1	J28R					1	J27M																					
R	V	007308		4.0	2	J28R					1	J28M																					
H	T	010217		9.0	1	KO1B					1	T11B	1.7		KO1P		1.7		T11A														
H	T	010205		7.5	1	KO1C					1	T06B	1.7		KO1P		1.7		T06A														
H	T	014296		20.0	1	KO1P					1	T23B																					
H	T			28.6																													

Figure 14 - Check List is Sorted in "from pin" Sequence and Contains all Wires in their Normal and Inverted Order. Logical Inconsistencies are Detected and Summarized.

INTER CHASSIS MASTER LIST				MACH 7101T				MFI				PREV E C 700021			
LOC.	15A	PART NUMBER	0545576	E	C	700015	RUN			PAGE	1				
LENGTH	NET	PAN PIN	PAN PIN	SHD	SHD	WT									
33 6/8	2620	1 B09E	2 J08C	1 B09J	2 J08J	C									
21 3/8	2835	1 B23C	2 H02D	1 B23J	2 H02J	C									
		1 B24E	2 J12D	1 B24J	2 J12J	C									
24 2/8	2606	1 B27F	2 H12F	1 C20J	2 G06J	C									
19 5/8	2909	1 C20C	2 G06F	1 B27J	2 H12J	C									
11 5/8	2904	1 C20F	2 B07E	1 C20J	2 B07J	C									
16 2/8	1943	1 C26E	2 D22G	1 C26J	2 D22J	C									
24 4/8	2675	1 C27E	2 J13C	1 C27J	2 J13J	C									
		1 D01B	2 G25E	1 D01J	2 G25J	C									
15 4/8	2805	1 D05N	2 D05C	1 D05J	2 D05J	C									
24	759	1 D06N		1 D06J	2	C									

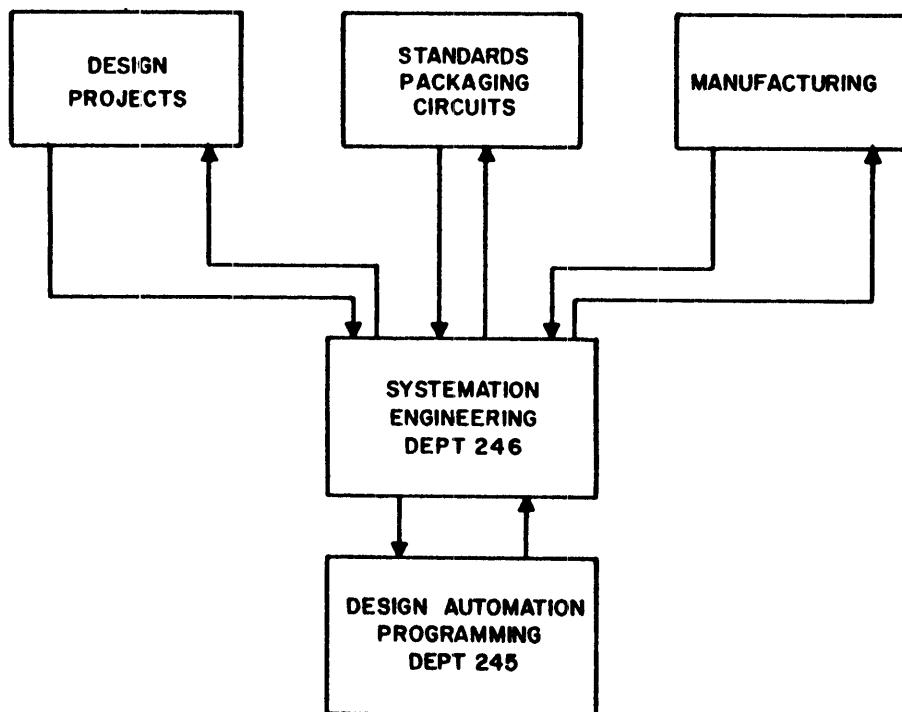
Figure 15 - Interpanel Jumper List Consists of Wires that Connect Directly from one Panel to another on the same Gate without Passing through the usual Edge Connectors.

## HOW TO IMPLEMENT DESIGN AUTOMATION

Development groups using the facilities of design automation should be familiar with organizational procedures and computer programs. The effective use of this system will directly reflect in the records maintenance, the man-power requirements, and the scheduling of a machine from the concept to release. The following points are offered as a guide for the effective implementation of design automation.

1. Contact liaison group, Dept. 246, for the assignment of personnel for technical assistance.
2. Instruct all engineers and designers on the input requirements.  
(This service available from Dept. 246.)
  - a. Logic grid sheets
  - b. Checking program - forms
  - c. Back panel wiring program - forms
3. Request manuals and all written information about design automation.
4. Assign personnel to coordinate with design automation about all pertinent problems regarding the records.
5. Coordinate new circuit information to insure compatibility and installation in the design automation programs.
6. Resolve all packaging problems to insure compatibility with the present and future programs.
7. Inform Dept. 246 about schedules of workloads.
8. Contact Dept. 240 for assistance in budgeting the use of design automation.

The Importance of Liaison cannot be stressed too much. Initial contact with design automation should be made through Dept. 246, Systemation Engineering. Design automation, on the other hand, is concerned with general subjects in three areas: design, standards, and manufacturing. A breakdown of subjects according to area is as follows:



#### **Liaison to Design Projects**

- A. Education**
- B. Procedure modifications**
- C. Program modifications**
- D. Circuit logical block descriptions**

#### **Liaison to Standards**

- A. Circuit logical block description**
- B. Program modifications due to package changes**

#### **Manufacturing**

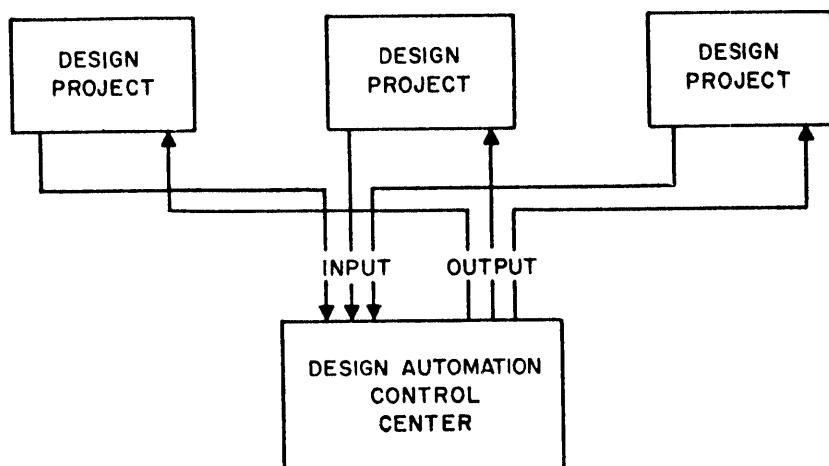
- A. Format of outputs**
- B. Input criteria for automated assembly machines**

Proper Scheduling of the Workload should be taken into consideration if bottlenecks are to be avoided. Managers of systems that comprise hundreds of system pages should be mindful of the delays that can arise if an excessive number of pages are submitted at one time. The initial transformation of the basic system page into machine language is the most time-consuming operation; therefore, pages should be submitted in groups of about thirty in chronological order of completion.

A second operation in which prior planning is important is the correcting of errors resulting from the checking programs. Large machines require three or four correction re-cycles before the system's pages are in order. Delays of one day or more during correcting periods eventually lead to three or four weeks before the systems are ready to extract panel wiring. This re-cycle time can be shortened by:

1. Forming teams of two or three men each to correct the errors.
2. Thoroughly examining each error code.
3. Have engineering assistance available when technical problems arise.
4. Accurately making corrections to the systems to eliminate any reoccurrence.

Understanding Work Flow can be an aid to those who maintain liaison with design automation. Representatives from design projects should submit all



production inputs to the control center, which is responsible for the scheduling of work through all of the stages of the program. Outputs, as well,

are controlled from the center, which also processes inquiries regarding the status of any job.

Facilities available at the computational laboratory, in addition to the control center, include:

System Page Control Section where the production inputs to Stage 1 are set up.

Keypunch Section where logic sketch sheets and changed system pages are keypunched into machine language.

System Page Edit Section where output pages are edited for accuracy.

Checking Control Section where the production inputs to Stage 2 are set up.

Panel Wire Control Section where the production inputs to Stage 3 are set up.

700 Series Computer Section where two 705 computers and one 704 computer are employed.

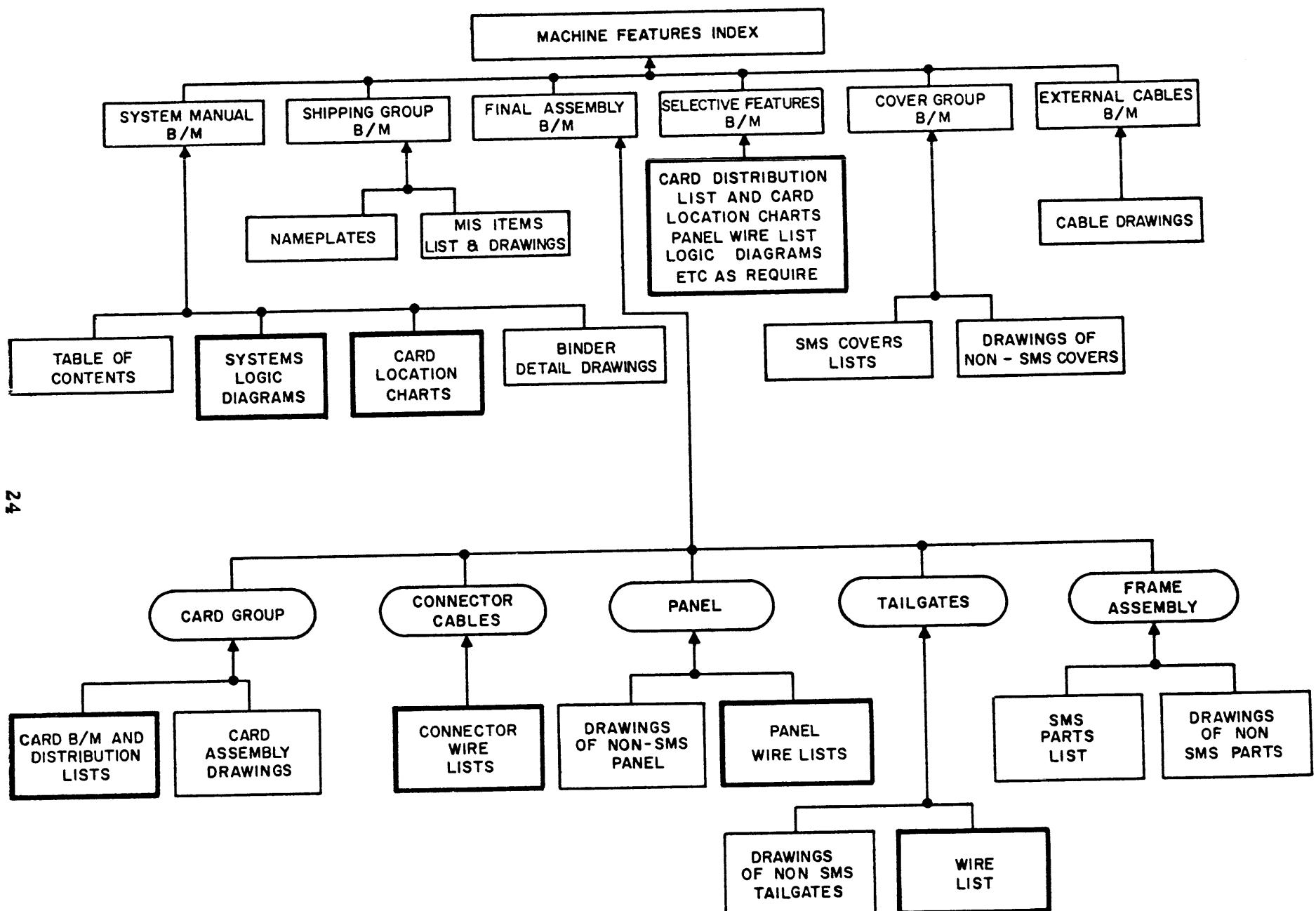
Tape Library where system logic pages and panel wire lists are retained on magnetic tape.

700 Series Program Release Office to control production programs.

Accounting Machine Section where miscellaneous card outputs from design automation programs are formalized.

To Release a Machine, the design groups furnish the Engineering Records Department with documents describing the machine. From these documents the Engineering Records group will compile the bills of material and the machines features index. The chart shows what these documents are, and in heavy lined squares which documents can at present be generated by design automation.

In addition, computer programs are used to maintain the bill of materials (Parts Usage Maintenance Programs or PUMP) and to maintain the table of content of system manuals (Change Control System Programs).



Documents Required for the Release of a Machine  
(Heavy-lined Blocks Indicate those Documents by Design Automation)



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